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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that the annexed is a true copy of the Provisional Specification as filed on 8 September 1998 with an application for Letters Patent number 331788 made by Lynley Ann Ellis and John Louis Coker both as trustees of the W C Ellis Family Trust.

Further Philip George Ellis is believed to be the true and first inventor of the invention.

Dated 30 September 1999.

Neville Harris
Commissioner of Patents

Patents Form No. 4

Our Ref: JM502048

Patents Act 1953

331788

PROVISIONAL SPECIFICATION

BUILDING FRAME AND METHOD OF CONSTRUCTION

We, **LYNLEY ANN ELLIS**, a New Zelaand citizen, of 12 Bushland Park Drive, Albany, Auckland, New Zealand and **JOHN LOUIS COKER**, a New Zealand citizen, of 1 Burnside Court, Albany, Auckland, New Zealand, both as trustees of the **W C ELLIS FAMILY TRUST**, do hereby declare this invention to be described in the following statement:

JM:RM:PT0477505

This invention relates to metal framing, in particular steel framing, for building construction. The invention also relates to a method of constructing a metal frame assembly and apparatus for producing metal framing for building construction.

The high costs of timber have made the use of steel framing in building construction cost effective. Known forms of steel frame construction require the riveting together of frame members which make up the studs and nogs of the frame. Since the frame members generally have a C-section it is necessary to bend back the lip at various points along a stud where a nog is to be interconnected . This bending out or flattening of the lip can introduce bending or deformation of the frame member. Furthermore, because all components of a frame are made from members of the same cross-section, the required overlapping of members when a nog is inserted between the sides of a stud results in localised deformation of the stud. Any deformations in the sides of the frame members results in an uneven planar surface of the frame with consequential difficulties in affixing a cladding to the frame with a preferred even finish.

A further limitation associated with conventional methods of constructing steel framing for building relates to the fact that the framing is manufactured off site in standard lengths. The construction of a frame from such preformed lengths at a construction site is labour intensive and therefore costly. Each standard piece has to be manually cut, punched and assembled on site.

Thus, it is an object of the present invention to provide a method of manufacture of a steel frame section for building construction, which reduces or overcomes the abovementioned problems, or which at least provides the public with a useful alternative. It is a further object to provide a method of constructing a metal frame assembly for building construction which reduces or overcomes the abovementioned problems, or at least offers the public with a useful alternative.

Other objects of the invention may become apparent from the following description which is given by way of example only.

According to one aspect of the present invention there is provided roll forming apparatus adapted to form, from sheet metal strip, metal frame members for use in building construction and adapted to form U-section and C-section channel profiles simultaneously on the same sheet metal strip.

Preferably, the roll forming apparatus may further be adapted to roll form different widths of channel profile at selected regions during a continuous roll forming operation.

According to a further aspect of the present invention there is provided a method of constructing a building frame assembly, said method including the steps of:

- recording data defining the design of a unit area to be filled by the frame assembly,
- storing the data on computing means,
- providing roll forming apparatus adapted to convert sheet metal strip into channel-shaped frame members,
- controlling operation of the roll forming apparatus via the computing means to produce frame members cut and formed ready for assembly to produce the required design of frame assembly.

According to a further aspect of the present invention there is provided a method of constructing a building frame assembly said method including the steps of:

- recording data defining a unit area in which the frame assembly is to fit,
- storing the data on computing means,

- designing a frame assembly to fit the unit area,
- providing roll forming apparatus adapted to form channel-shaped frame members from sheet metal strip,
- controlling operation of the roll forming apparatus via the computing means to produce frame members cut and formed ready for assembly to produce the required design of frame assembly.

Preferably the designing step may also be performed by the computing means.

According to a further aspect of the present invention there is provided a frame assembly for use in building construction, the assembly including a plurality of metal frame channel members, ends of selected channel members having a U-section swaged or narrowed portion adapted to engage within the sides of a U-section portion of another frame member without deforming the profile of the other frame member.

Preferably, the frame assembly may include a plurality of first metal frame channel members forming studs and a plurality of second metal frame channel members forming nogs.

Preferably, the selected channel members are nogs.

Preferably, the nogs have a C-section profile with U-section ends.

Preferably, the studs may have a C-section profile with interspersed U-section portions at predetermined intervals.

Preferably, each nog may have a base of the channel cut away in the U-section swaged or narrowed portion at one end, leaving lateral engaging members at that end.

Preferably, each metal frame channel member may have at least one longitudinal slot in the base of the channel member.

Preferably, the swaged or narrowed portion of the nogs may be formed by increasing the depth of the or each longitudinal slot.

Preferably, the studs may have lateral slots formed in the channel base at the or each U-section portion, adapted to receive the lateral engageing members of a nog.

According to a further aspect of the present invention there is provided a frame assembly substantially as herein described and with reference to the accompanying drawings.

According to a further aspect of the present invention there is provided a method of constructing a metal building frame assembly for use in building construction substantially as herein described and with reference to the accompanying drawings.

According to a further aspect of the present invention there is provided roll forming apparatus substantially as herein described and with reference to the accompanying drawings.

Other aspects of the present invention may become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1:
Shows a perspective view of a junction between nogs and a stud of a metal frame assembly of the present invention;

Figure 2:
Shows a junction between an end of a stud and a base plate, or an end of a nog and a stud, of a metal frame assembly of the present invention;

Figure 3:
Shows a nog of an assembly of the invention in one preferred form;

Figure 4:
Shows a schematic representation of roll forming apparatus of the present invention in one preferred form.

This invention has several aspects all directed towards the efficient construction of metal frame assemblies. Hereafter, such assemblies and their components are referred to as steel frame members or assemblies since steel is the current metal of choice. However, it will be appreciated that other metals or alloys may be used.

The first aspect of the invention relates to a method of construction of steel frame members in a form which facilitates assembly of the frame and which enables a frame to be produced with substantially planar surfaces. This is achieved by using roll forming apparatus to produce the steel frame channel members with a U-cross-section and forming this into a C-cross-section only at portions between intended junctions. It is further facilitated by including one or more longitudinal ridges or slots in the base of the channel and increasing the depth of the or each ridge at ends of a section which will need to be engaged within an interconnecting section.

Increasing the depth of the ridge narrows or swages the end of that section so that the end will engage within the C-section of another unit without splaying the sides of that other unit.

Figure 1 shows a typical interconnection between nogs 2, 3 and a stud 4 in an assembly of the present invention.

At the region of interconnection 9 the stud 4 and ends 5, 6 of the nogs 2, 3 have a U-shaped cross-section. At intermediate points they have a C-shaped cross-section, with rolled-over lip edges 7. In the base 8 of each frame member there are longitudinal ridges 10.

The end 6 of nog 3 is swaged or narrowed slightly to engage neatly within the U-shaped part 9 of the stud 4. This is more readily apparent from Figures 2 and 3.

Slots 11 may be formed in the edges 12 of the base of the stud 4 at the region of intended interconnection with a nog. With reference to Figure 3, nog 2 has an end portion 13 of the base cut away, leaving side portions 14 extending beyond the end of the U-section. These side portions 14 are narrowed or swaged in relation to the remainder of the section in order to engage neatly through the slots 11 in the stud.

In an alternative configuration, and to avoid the need for forming lateral slots in the stud, the stud may be swaged or narrowed at the regions of intended connection with nogs. The end of a nog having the cut-away base and extending side portions would not then be swaged, but the side portions would rather engage about the outside of the swaged portion of the stud. The nog on the other side of the stud, if any, would still have a swaged portion adapted to engage within the stud channel.

Holes may have been prepunched through the sides of the stud and nogs to receive rivets 15 which securely engage the components of the assembly together. Recesses or dimples 16 may also be preformed in the outer surface of the stud, about the punched hole so that a rivet head is recessed or substantially flush with the stud side surface.

With this design of assembly there is no deformation of the sides of the stud at the regions of interconnection with nogs, ensuring that cladding applied to the surface of a constructed frame will have an even finish.

Figure 2 shows the connection between the bottom of a stud 20 and a base plate 21, although this could equally represent interconnection of the nog 3 of Figure 1 into its stud 2. It can be seen that the base plate 21 differs from the stud 20 primarily in having a C-section along its entire length, there being no requirement for the strengthening achieved by rolling to form a C-section. The U-section end 22 of the stud 20 is narrowed or swaged to engage within the base plate 21 without deforming the sides of the base plate.

The narrowing or swaging of ends of frame members is achieved in the process of manufacturing each section by increasing the depth of the ridges 10.

A second main aspect of the invention relates to the method by which the individual components of a required frame assembly are manufactured. This is achieved by use of portable roll forming apparatus adapted to produce frame members of the desired configuration from galvanised flat steel in coil form at the site of construction.

With reference to Figure 4, the roll former 41 includes a fist set of rollers 42 adapted to convert the flat steel 43 from the coil 44 into a U-shaped channel. Lip

rollers 45 are provided to convert parts of the U-shaped channel into a C-section. Swage rollers 46 introduce the ridges in the base of channel, and are adapted to control the depth of the ridges.

A moving tool bed 47 is provided, and this tool bed may include a slitter 48 for producing slits in the sides of the base of the channel at the regions of intended interconnection, a service hole punch 49 adapted for producing holes for electrical wires, plumbing pipes and the like, a notcher 50 for removing a section of the base of the channel which then leaves protruding side portions of a nog for engagement in a stud, and a guillotine and hole punch unit 51 for punching and optionally counter-sinking rivet holes and guillotining each frame member to length.

At least one set of the first rollers 42 may be knurling rollers 53 adapted to form textured outer sides of the U-channel. The knurling of the sides of the channel assists in preventing screws from slipping when applying a cladding such as Gibraltar board to a completed assembly.

The roll forming apparatus 41 is adapted to produce U-shaped and C-shaped section simultaneously by control of the lip rolling function. This enables framing sections to be produced which do not require flattening of lip portions to enable interconnection of the end of one member within the channel of another. Similarly, the swaging or narrowing of profile at desired regions can be achieved within the single roll former in a continuous operation.

The roll forming apparatus is controlled by computing means.

The roll forming apparatus may be driven by hydraulic motor or alternatively by an electric motor. It is preferably adapted to roll from 0.4 to 1.2 millimetre gauge steel or galvanised steel.

Optionally, the roll former may also include a straightening station, comprising vertically disposed pairs of rollers about each side wall for lateral straightness and a pair of horizontally disposed rollers for vertical straightness, to ensure that each frame member is straight. Flat steel in coil form is not always straight, and this can result in bends or warps in individual lengths of building elements.

In the preferred method of producing a building frame assembly of the invention the measurements of a space for which a frame assembly is required may be taken from the physical construction set-out or a plan and entered manually, or automatically by a laser measuring device, into the computing means. A frame design software package may then be employed to convert the basic data into the required frame design. This design may include not only the dimensions of the space but also the locations and dimensions of architectural and other features required to be accommodated in the space, such as windows, doors, air-conditioning ducts, electrical sockets and switches and the like. The length and configuration or form of each frame member for this design assembly are calculated by the computing means, which in turn controls operation of the roll former to form each required frame member from the flat steel coil in a substantially continuous operation.

Thus, by employing the method of the present invention involving the roll forming apparatus described, customised frame assemblies to fit spaces having specified design characteristics can be manufactured and constructed conveniently and efficiently on site without the problems associated with the use of standard preformed steel frame members which must be manually cut, punched and forced together in a manner which often results in the deformation of the smooth surfaces to which cladding must be applied.

Where in the foregoing description reference has been made to specific components or integers of the invention having known equivalents then such equivalents are herein incorporated as if individually set forth.

Although this invention has been described by way of example and with reference to possible embodiments thereof it is to be understood that modifications or improvements may be made thereto without departing from the scope or spirit of the invention.

331788

LYNLEY ANN ELLIS and
JOHN LOUIS COKER

By their Attorneys
BALDWIN SHELSTON WATERS

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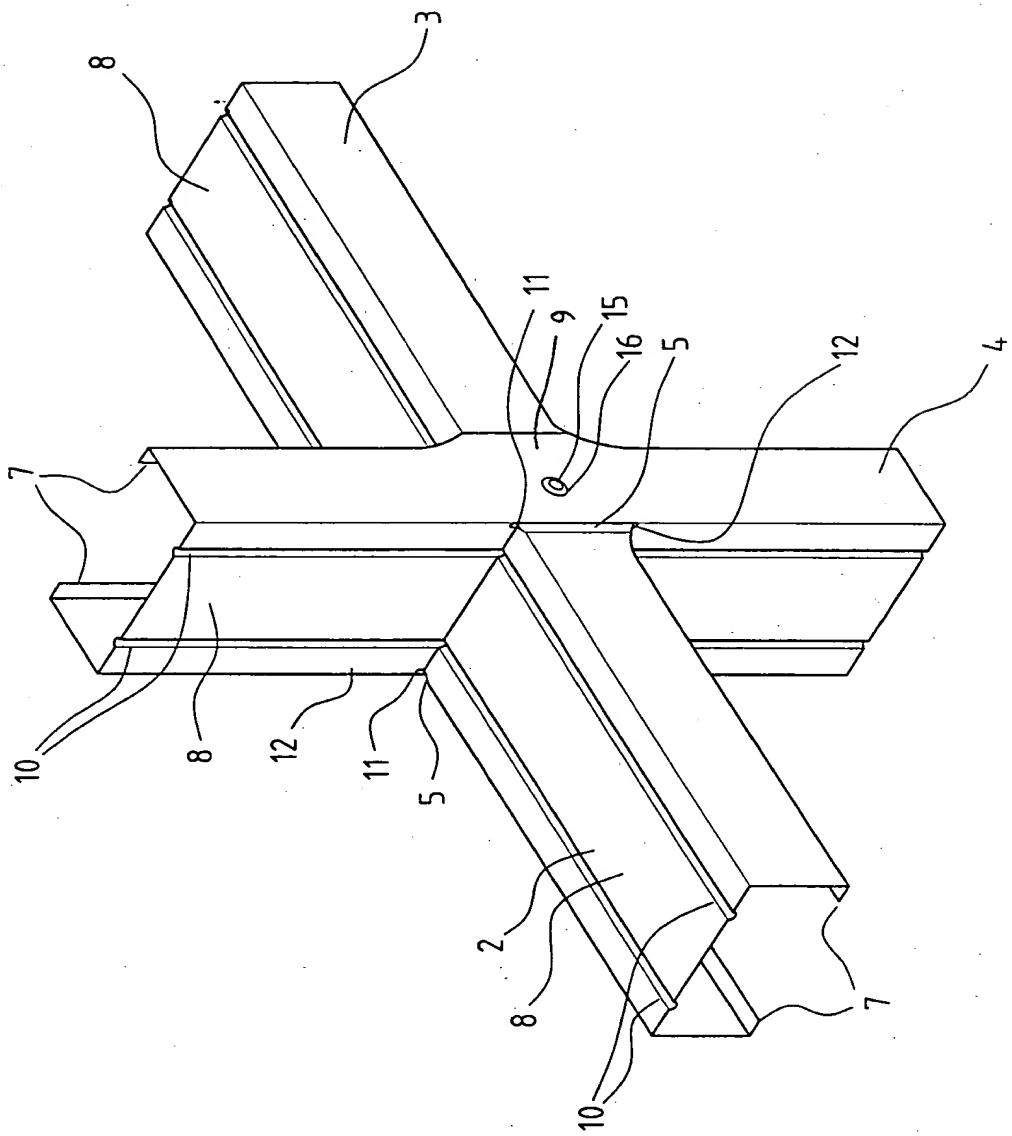

FIG.1.

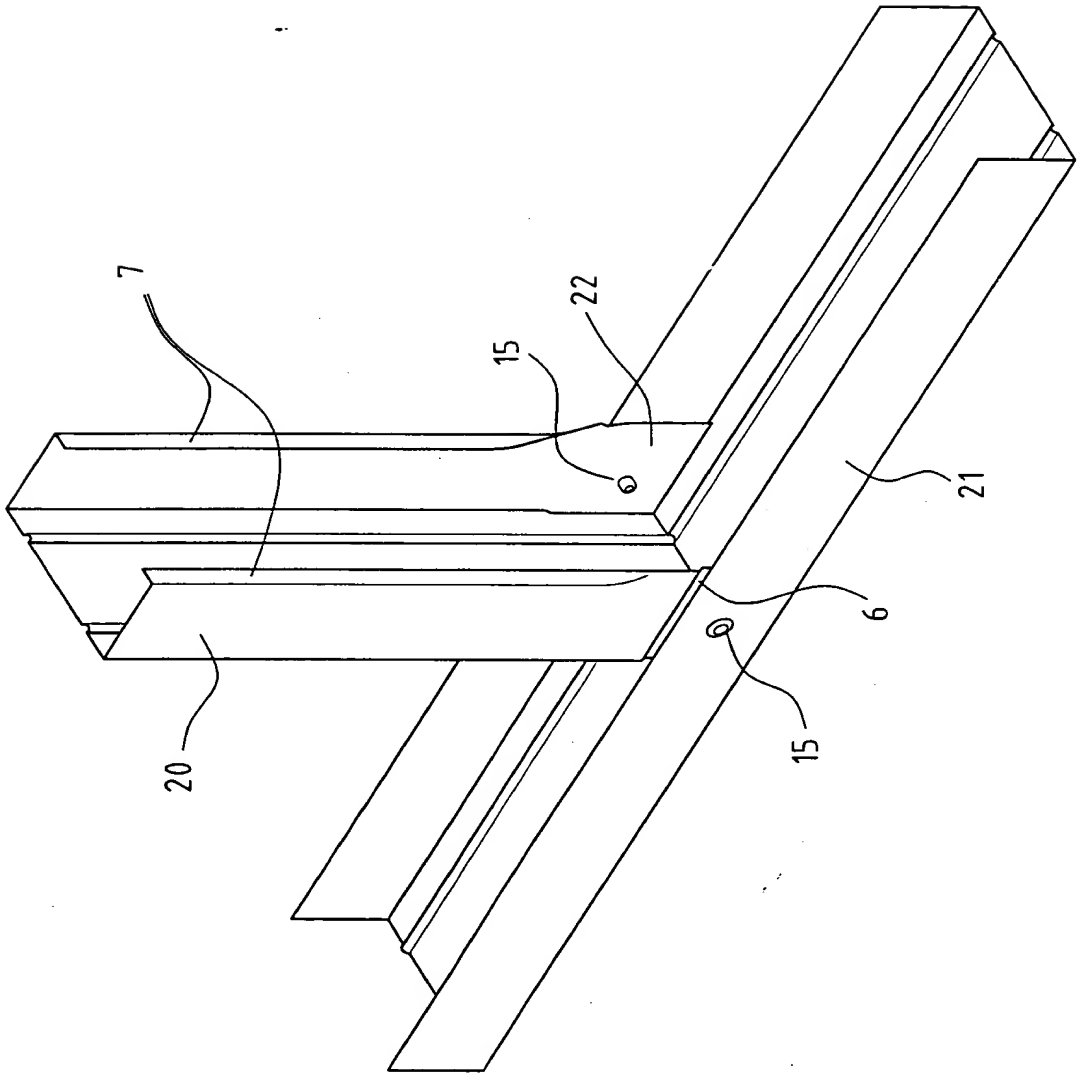

FIG.2.

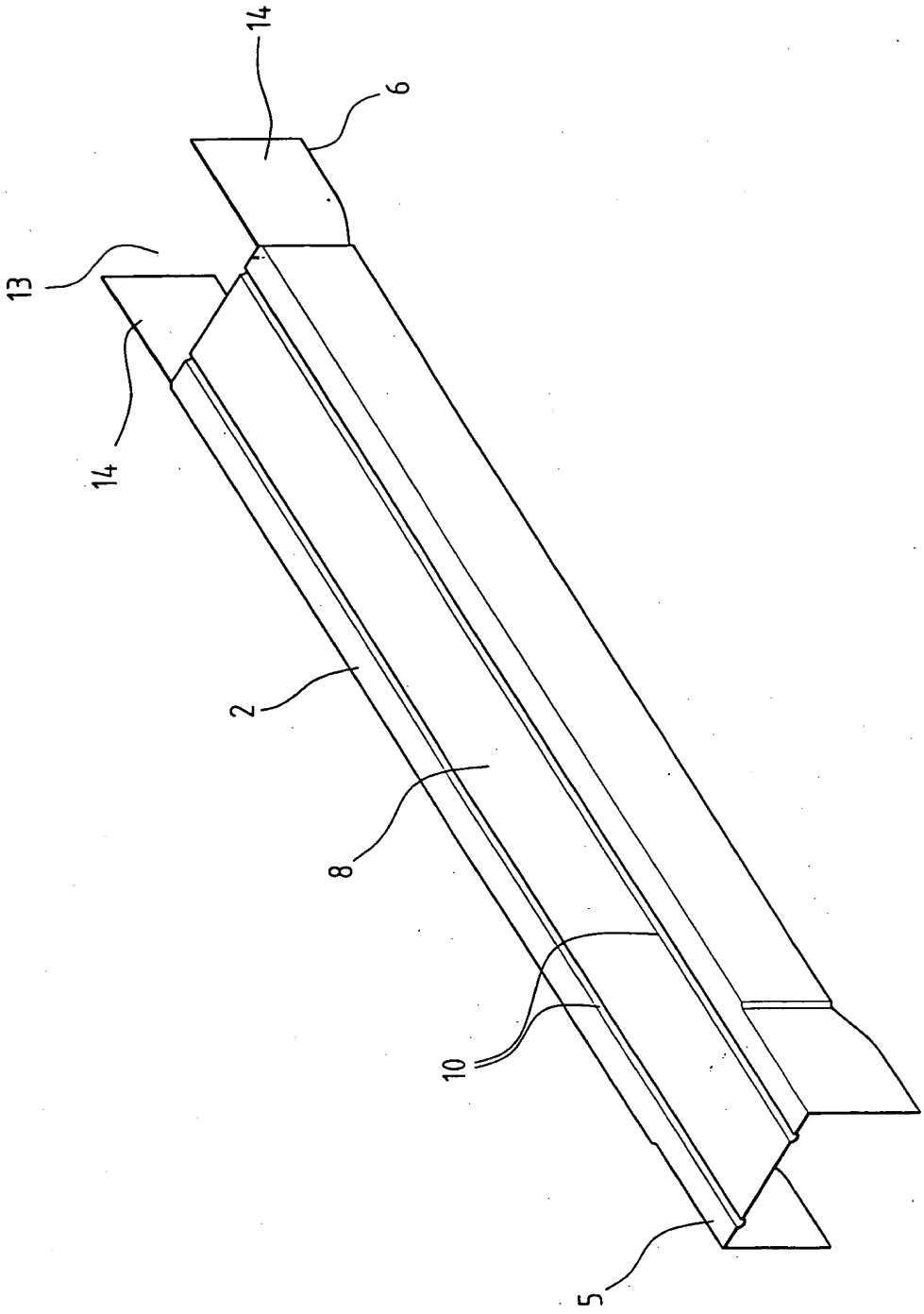

FIG.3.

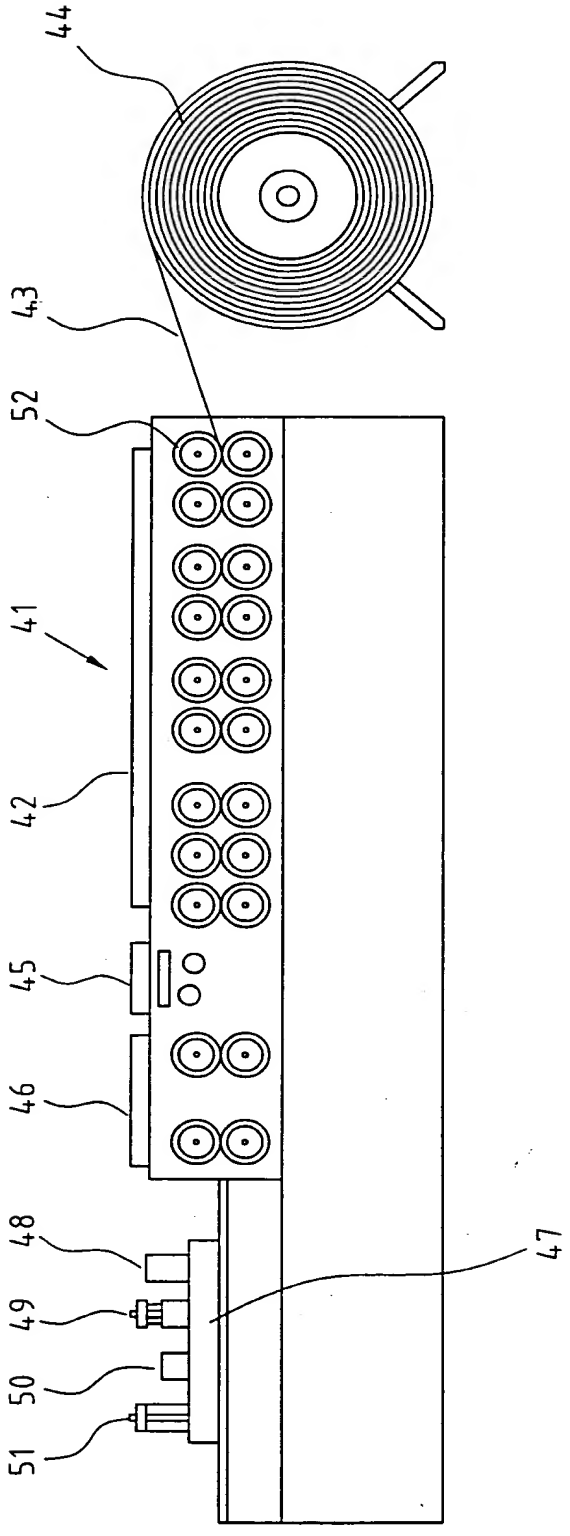

FIG.4.